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## GUATEMALA AND THE HIGHEST NATIVE AMERICAN CIVILIZATION.

By ELLSWORTH HUNTINGTON.

*(Read April 18, 1913.)*

By common consent the most backward part of our continent is Central America. Among the republics of Central America Guatemala is considered to hold the lowest place. In Guatemala it is universally agreed that the province of Peten is the wildest, most uncivilized and most uninhabitable part. Peten, then, may be regarded as at the very bottom in the scale of American civilization. Its native inhabitants are either absolute savages, or semi-barbarians, densely ignorant and highly inefficient. Nevertheless in the past this region was the home of the highest civilization that ever developed in any part of the western hemisphere, a civilization which was not transitory, but lasted hundreds of years. It seems to have grown up where we find its traces, since nowhere else do we discover any premonitions of it. Here the ancient Mayas developed a unique system of architecture, whose earlier stages appear at Copan and the ruins of Peten, while its latest and most showy, although decadent, expression is found in the wonderful ruins of Yucatan a few hundred miles farther north. In this same part of Guatemala the Mayas developed the art of sculpture to such a point that their statues, though crude in many ways, represent the features of the ancient populace so exactly that type after type among the modern population is easily recognized in the monuments. Here the Mayas attained such skill in the mechanic arts that great stones fifteen to thirty feet long, and weighing 20 to 80 tons were transported from quarries a mile or two away and set up in the midst of great court-yards or temple areas. The buildings themselves were elaborately planned and decorated with all manner of carefully carved designs. All this was done with no tools, so far as can be

ascertained, except obsidian or flint. A greater achievement than this, however, was the construction of a calendar much more accurate than any known even in Europe until the introduction of the Gregorian calendar which we now employ. The construction of such a calendar must have demanded carefully written records for hundreds of years. This brings us to the greatest of the achievements of the Mayas. They had developed the art of writing in hieroglyphics, and apparently their type of hieroglyphics was higher than that of the Egyptians, for they seem to have been on the point of using specific symbols not to represent words but sounds, a step which even the Chinese have not yet taken.

From the point of view of the geographer, and perhaps of the historian also, the most remarkable feature of the civilization of the Mayas is that it developed in almost the worst physical environment to be found in any part of America. It might have developed in the healthful plateau of Guatemala where cultivation of the soil is easy, and where the population to-day is dense and relatively efficient, but instead of this it developed a hundred miles away in the fever stricken lowlands of Peten, where agriculture is extremely difficult and the population almost negligible. To-day for some unexplained reason the distribution of population and still more of culture in Guatemala is utterly different from what it was in the past. Perhaps nowhere else in the whole world have less than 2,000 years produced so profound a change, not only in the state of civilization as compared with other parts of the continent, but in the relative importance of different portions of the same small country no larger than the state of New York. The normal decay of races, the interplay of historic forces, the invasion of barbarians, the decadence due to luxury, vice and irreligion, the change of the center of world-power, or some of the other causes usually appealed to by historians may explain why the Maya civilization arose and why it fell. We may assume that it arose because it is the nature of a young and vigorous race to make progress, and that it fell because it is the nature of an old and exhausted civilization to decay. This, however, does not touch upon the problem which we propose to discuss in this paper. To-day the most progressive and energetic

people of Guatemala, its densest population, its greatest towns, its center of wealth, learning and culture, so far as these things exist, are all located in the relatively open, healthful, easily accessible and easily tillable highlands; in the past these same things were located in the most inaccessible, unhealthful, and untillable lowlands. Why the change?

Before we attempt to answer this question, it will be helpful to discuss the geographical provinces of Guatemala as they exist to-day, and as they were seen by the author during a recent visit, and to compare them with one another. From the point of view of present habitability Guatemala together with British Honduras, which is physically part of the same country, may be divided into three main belts dependent on vegetation,—(1) the Atlantic forest, (2) the central dry land, and (3) the Pacific forest. Each of these in turn may be divided into two parts. The plain of British Honduras in the north to a width of fifty miles, and the mountains of the southern part of that country and of eastern Guatemala to a distance of perhaps thirty miles from the coast form the first division of the Atlantic forest. Showers at all seasons either from the trade winds in our winter, or from the subequatorial area of low pressure in summer cause the land to be covered with a dense tropical forest, and to be infested with malignant types of malarial fevers. Only on the coast are there any real towns, and they exist chiefly by grace of the trade winds, which blow freshly from the ocean and drive away the mosquitoes. Strung along the beach under the cocoanut palms the low whitewashed houses of these towns make quite a show from the sea, but back of the first row there is often nothing but deadly swamp and mosquitoes. In the interior a few little villages sit in clearings by the brink of the somber rivers, and wait in sun or rain for precious mahogany logs to be hauled or floated out of the interior. Save for this, almost no one except an occasional gatherer of gum inhabits the dense forests. If the coast towns and the mahogany cutters be excluded the whole region cannot boast a population of much more than one person to every ten square miles, while even if the towns and woodcutters be included, British Honduras with an area of 7,500 square miles has only

42,000 people, or less than 6 to the square mile. The forests and fevers now keep mankind away, and apparently much the same was true in the past, for we find here only a few widely scattered ruins.

Inland from the coast strip there lies another section of the Atlantic forest, occupying most of the almost unexplored and semi-independent Guatemalan province of Peten, and extending south past the ruins of Quirigua towards those of Copan. In the north this Peten strip consists of a plain from which rise a few low ridges running east and west, and having a height of a thousand feet more or less. In the south it becomes mountainous. The vegetation is almost as dense as that of the coast strip except that in Peten considerable areas of grassy savanna prevail, thin pine forests grow in the sandy tracts known as "pine ridges," and on the westward edge and in other favored spots, among which Flores on L. Peten is the chief, the forest breaks down into jungle. The savannas appear to be due either to an excess of water often held near the surface by clayey hardpan, or to sand. The pine ridges, which are not ridges but merely slight swellings in the plain, are due to accumulations of sand. Neither in the past nor at present does it ever appear to have been possible to cultivate either the savanna or the pine ridges, but since the introduction of cattle by the Spaniards they have been utilized somewhat for pasturage. They possess not only the advantage of being fit for cattle-raising, but of being relatively healthful, and of being bordered by narrow strips of jungle wherein primitive agriculture is possible. The jungle regions on the immediate borders of the Peten strip contain a few villages, among which Copan is most worthy of mention. Aside from the limited areas of savannas, pine ridges, and jungle, the country is covered with forest, and is so feverish and so difficult to cultivate that its only inhabitants are mahogany cutters, gatherers of chicli gum, or raisers of bananas for export. All of these occupations, together with cattle-raising, are due entirely to the influence of modern European civilization, and had no place in the pre-Columbian period. The banana plantations have grown up within a few years and are practically all the work of the United Fruit Company, which employs four or five thousand people in the valley of the Motagua river.

Only some powerful stimulus, like the demand of the United States for fruit, could cause such plantations to arise. The strictest supervision is necessary in order that the bushes may be cut every three months, for in a year the native vegetation grows ten feet or so, and if left to itself would soon choke the banana plants. Still more unremitting vigilance is necessary to keep both the white men and the natives in health. From the wages of every employee, whether he receive fifty cents or fifty dollars per day, the Company takes two per cent. to pay for sanitary measures. Every plantation has its doctor and dispensary, and natives and foreigners are continually dosed with quinine. Yet even so, at certain seasons of the year, a single train may carry a score of staggering fever patients, the present hospitals are wholly inadequate, and in 1913 the company was erecting a new hospital at a cost of \$125,000. Mr. Victor M. Cutter, manager of the Guatemala division of the United Fruit Company, states that about ninety per cent. of the people in his district, both natives and whites, suffer from malaria and its sequelæ. In spite of all precautions about twenty per cent. have the fever in a serious form.

In the entire Peten strip of the Atlantic forest, from Copan on the south up through Quirigua, the lake of Izobal and the province of Peten, it is probable that the total population does not exceed 20,000 in an area of nearly 15,000 square miles. If the cattle-raisers, mahogany cutters, gum gatherers, and banana raisers be excluded, and if we include only the people who procure a living in ways possible before the coming of the white man, the population is reduced to probably less than ten per cent. of the figures given, or only one person for seven square miles. Of course these figures are a mere approximation; there is no such thing as a census, for much of the country is still unexplored, and the wild Indian tribes practically ignore the Guatemalan supremacy. For day after day, however, the traveler finds no inhabitants, and place after place which appears on the map as a village proves to have only two or three houses or to be merely an abandoned hut. Roads and even trails are almost non-existent, and in most places the machete must constantly be used to open up a pathway. Mr. Frank Blanceneaux,

who for six or seven years spent a large part of his time in traveling through Peten in search of mahogany, probably knows that province as thoroughly as any one. He thinks that the population does not exceed 10,000, and that at least 95 per cent. of it consists of cattle raisers, mahogany cutters and gum gatherers. Nowhere has he seen a village of more than a hut or two in the genuine forest, and nowhere do people practice any real agriculture in the forest as opposed to the jungle. South of Peten, along the line of the railroad from Puerto Barrios to Guatemala, for sixty miles from the Atlantic coast until one comes to the poor little village of Los Amates, there would not be a single inhabited place were it not for the railway itself and the banana plantations of the United Fruit Company. Los Amates lies on the edge of the forest where it breaks down into big jungle.

Whatever may be the exact figures as to population it is evident that heavy rains, dense vegetation, and malignant fevers to-day render the Peten strip of the Atlantic forest almost uninhabitable. Yet in the past this was by no means the case. Practically all of the great Maya ruins outside of Yucatan lie in this strip or in its northern and northwestern continuation in the Mexican provinces of Chiapas, Tabasco and Campeche. Copan, one of the most remarkable of the ancient cities, lies on its edge, although not actually in it; Quirigua lies within it, although only a few miles from the border; and Seibal, Tikal, and a score of others as far as Palenque in the north, lie well within its dense jungle and forests. These places were obviously towns of importance, such as grow up in interior, agricultural districts far from important lines of communication only when there is a considerable population round about. How dense the former population may have been we cannot estimate, for the cover of vegetation is so thick that we have no idea of the exact number of ruins. It is scarcely an exaggeration, however, to say that for every family now supported by ordinary agriculture, there was probably a village or hamlet, in the days of the Mayas, and for every modern village a city.

Turning now to the relatively dry portion of Guatemala, the second of our three divisions, we find it divided into arid bush

country, lying in low, isolated valleys or basins such as Zacapa, and highlands where pine or temperate forests prevail. The bush country is unimportant, being of small area. In some places it is so hot and dry that cacti and mesquite bushes make it look like the lowlands of Arizona. It is fairly well inhabited and moderately healthful. The people are in advance of the poor denizens of the forest zone but are miserably inefficient, idle, weak-willed, and immoral. The real strength of Guatemala is in the highlands, where the vegetation takes on an aspect suggestive of the temperate zone. There, on the plateau amid pine-clad hills at an altitude of 4,000 to 8,000 feet, all the large towns are now located. The conditions of health, from a tropical point of view, are everywhere good. Typhus, dysentery and other disorders, to be sure, often sweep the country; and faces pitted by smallpox are frequently seen. These diseases, however, although causing a high death rate, are temporary. Their ravages are as nothing compared with those of the deadly malarial fevers which in the lowland forests return season after season to blight and destroy the same places and the same people. From the coast upward, according to universal testimony, the health, energy, industry, and thrift of the native Guatemalans in general show an increase. It seems a curious reversal of what we are wont to call normal conditions, when one sees rich, fertile plains along the coast almost uninhabited, then finds the population fairly dense on steeply sloping, stony mountain sides at altitudes of three to five thousand feet, and finally on the hilly plateau at 8,000 feet sees little thatched houses clustering thickly everywhere, and every available bit of land almost as carefully and industriously cultivated as in China. Even more curious, perhaps, is the fact that here where the population is now so dense there are relatively few important ruins and none of the advanced type found in Peten. There is no reason to think that ruins which once existed have disappeared to any greater extent than has happened in Egypt, Syria, Greece, Rome, or any other country where a high civilization in the past has been followed by a dense population at present. Moreover ruins of a certain kind are found in considerable numbers, but they are insignificant and probably of late date compared with those of Peten. The carved



stones which one sees, for example, at Guarda Viejo near Guatemala City are small, crudely executed, and inartistic, utterly different from the clean-cut, highly complex and truly artistic stelæ of enormous size at Quirigua. The plain, almost unadorned structures at Quiché, the greatest ruins on the plateau, bear to the highly developed groups of buildings and monuments at Copan about the same relation that modern Guatemalan churches bear to St. Peter's at Rome. In the days of the Mayas the highlands may have been as densely populated as to-day, although we have no positive proof of this, but instead of being the center of the life and activity of the country they were a provincial outpost.

The southwestern side of the high plateau of Guatemala is bordered by a line of splendid volcanoes at the foot of which towards the Pacific Ocean there lies a narrow plain. This plain, together with the lower slopes of the mountains, forms the third of our three divisions of Guatemala from the point of view of habitability. From a height of 4,000 feet down to about 500 the slopes of the mountains and the inner edge of the plain are covered with dense vegetation. At an altitude of approximately 2,000 to 3,000 feet, the vegetation attains the dignity of real tropical forest with mahogany trees, tree ferns and the like, while on either side it assumes the form of forest-like jungle merging gradually into pine forest toward the uplands and low jungle and bush toward the coast. All except the upper mountainous part of the region is malarial and unhealthy; although not so bad as the Atlantic forest because the drainage is better. The strip of real forest would to-day be practically uninhabited were it not that the demands of the modern civilized world have led to the cultivation of coffee, chiefly by German companies with Indian labor brought from the highlands. Lower down, on the edge of the plain, there would be a small population even without the impetus of coffee. A few little towns like Retalhuleu, Santa Lucia, and Escuintla date back many centuries. They are notoriously unhealthy, however; their inhabitants are universally pronounced inefficient and apathetic; and their population of from 2,000 to 10,000 people is only 10-20 per cent. as large as that of corresponding towns on the plateau. Yet, here, curiously enough, we

again find abundant traces of an ancient race of relatively high culture. The ruins are by no means equal to those of the Peten strip, and there appear to be few hieroglyphics. Nevertheless they belong to the same civilization although to a later stage subject to foreign, that is Nahua, influence. At places like Baul and Pantaleon great blocks of hard basalt have been found carved with scenes of sacrifice, or chiseled to represent gigantic faces whose peculiar types of slit nostril, high cheek, or projecting mouth can still be recognized in individual Indians.

The seaward portion of the Pacific belt needs little further comment. Beginning with jungle where the modern towns and ancient ruins come to an end, its shoreward portion is covered with dense, low bushes among which short bamboos are often conspicuous. Although dry and parched in the winter season, much of it becomes a vast swamp when the rains swell the mountain streams and cause them to spread out over its flat expanses. Mosquitoes then abound causing fevers which are often of the "pernicious" type accompanied by hemorrhages of blood producing immediate death. Practically the only inhabitants are a few cattle raisers, who are described as the lowest of the low. In the past, conditions were apparently no better, for we find no trace of ruins here.

Before we consider the possible causes of the contrast between the past and present, it will perhaps add to the clarity of our ideas if our six belts are arranged in tabular form.

It is worth while to emphasize the strange contrast between past and present. The belts immediately along the Atlantic and Pacific coasts may be left out of account, since in the past, just as at present, they appear to have been too forested and too feverish for human occupation to any great extent. To-day the other four divisions stand in the following order so far as progress, achievement, and density of population are concerned; first the highlands, second the dry valleys, third the coffee belt, fourth the Peten strip. In the past the ruins tell a very different tale,—the Peten strip stood first, then the coffee belt and the dry valleys, and last of all the highlands, the reverse of the present order. To-day, in Central America, the physical conditions under which mankind tends most to increase in

	Nature of Vegetation.	Health Conditions.	Condition of Agriculture.	Present Density of Pop.	Condition of Population.	Abundance and Condition of Ruins.
1. Atlantic coast	Dense forest	Very unhealthful	Very difficult	Very scanty	Degraded	Very few so far as known but of fairly high type
2. Peten belt	Dense forest with some savanna and jungle	Very unhealthful	Very difficult	Very scanty	Degraded	Numerous and indicating the highest native American culture
3. Dry valleys	Bush or low jungle	Fairly healthful	Fairly easy	Moderately dense	Low, but well ahead of 1, 2, and 6	Moderately numerous and of fairly high type
4. Highlands	Pine forest	Healthful	Easy	Very dense	By far the best in Guatemala	Quite numerous, but mostly of rather low type, that is, provincial or degenerate
5. Pacific coffee belt	Forest and jungle	Unhealthful	Fairly difficult	Rather scanty	Low, but ahead of 1, 2, and 6	Moderately numerous and of fairly high type
6. Pacific coast	Bush	Very unhealthful	Difficult	Very scanty	Degraded	None so far as known

numbers and to progress in culture appear to be high altitude, good drainage, and a fairly long, dry season. Altitude in itself, however, does not appear to be essential, for the low dry plain of northern Yucatan seems as well off as the highlands of Guatemala. Perhaps the exposure of that part of Yucatan to the ocean and to strong winds from the north produces the same effect as elevation. Opposed to these favorable conditions stand those which conspire to hold man back and keep him in a low stage of civilization. Omitting low altitude, which is important merely because of its effect on other factors, we are confronted by four chief conditions,—first, the prevalence of fevers; second, the prevalence of great heat and moisture almost without change from season to season; third, the difficulty of carrying on permanent, intensive agriculture and fourth, the relative ease of getting a living in the jungle.

Little by little the world is learning that the most dangerous diseases are not necessarily those which show the highest deathrate.

The plagues of the Middle Ages loom large in history, but they did not do a tithe as much harm as syphilis. Yellow and typhus fevers may decimate a population, but they are far preferable to the slow, irresistible ravages of recurrent malarial fevers which rarely seem to kill, but merely undermine the constitution, leaving both mind and body inefficient. Tuberculosis, in our own land, is so dreaded that we wage a crusade against it, but its dangers are probably far less than those of the insidious colds which year after year attack fully half of our northern populations, not killing them, not even doing more than spoil their work for a few days, and yet in the aggregate causing an incalculable amount of damage and giving an opening for a large part of our cases of consumption, diphtheria, deafness, and many other afflictions. Just as we, in our huge folly, long neglected consumption and still largely neglect the even more insidious ordinary colds, so the man within the tropics often ignores malaria. Again and again I have talked with people who said there was no fever in the particular place where they lived or that they had not had fever, but before the next meal they took a dose of quinine, and that same night, perhaps, they reeled with a touch of fever or shivered with a chill. They called it "nothing," but even quinine did not prevent them from being weakened by it. Few foreigners, especially children, can live long in the lowlands under ordinary conditions without being affected.

As for the natives, it is often stated that they become immune to fevers, but here is what Sir Ronald Ross, one of the chief authorities on the subject, has to say:

"These diseases do not affect only immigrant Europeans, they are almost equally disastrous to the natives, and tend to keep down their numbers to such a low figure that the survivors can subsist only in a barbaric state. To believe this one has to see a village in Africa or India full of malaria, kala-azar, or sleeping sickness, or a town under the pestilence of cholera or plague. Nothing has been more carefully studied of recent years than the existence of malaria amongst indigenous populations. It often affects every one of the children, probably kills a large proportion of the newborn infants, and renders the survivors ill for years. Here in Europe nearly all our children suffer from certain diseases—measles, scarlatina, and so on. But these maladies are short and slight compared with the enduring infection of malaria. When I was studying malaria in Greece in 1906 I was struck with the impos-

sibility of conceiving that the people who are now intensely inflicted with malaria could be like the ancient Greeks who did so much for the world; and I therefore suggested the hypothesis that malaria could only have entered Greece at about the time of the great Persian wars—a hypothesis which has been very carefully studied by Mr. W. H. S. Jones. One can scarcely imagine that the physically fine race and the magnificent athletes figured in Greek sculpture could ever have spent a malarious and spleno-megalous childhood. And conversely, it is difficult to imagine that many of the malarious natives in the tropics will ever rise to any great height of civilization while that disease endures amongst them. I am aware that Africa has produced some magnificent races, such as those of the Zulus and the Masai, but I have heard that the countries inhabited by them are not nearly so disease-ridden as many of the larger tracts. At all events whatever may be the effect of a malarious childhood upon the physique of adult life, its effects on the mental development must certainly be very bad, while the disease always paralyses the material prosperity of the country where it exists in an intense form.

“Consider now the effects of yellow fever, that great disease of tropical America. The Liverpool School sent four investigators to study it, and all these four were attacked within a short time. One died, one was extremely ill, and two suffered severely. The same thing tended to happen to all visitors in those countries. They were almost certain of being attacked by yellow fever, and the chances of death were one to four. Tropical America was therefore scarcely a suitable place for a picnic party! But malaria and yellow fever are only some of the more important tropical diseases. Perhaps the greatest enemy of all is dysentery, which in the old days massacred thousands of white men, and millions of natives in India, America, and all hot countries, and rendered survivors ill for years. Malaria has always been the bane of Africa and India; the Bilharzia parasite of Egypt; and we are acquainted with the ravages of kala-azar and sleeping sickness. Apart from these more general or fatal maladies, life tends to be rendered unhealthy by other parasites and by innumerable small maladies, such as dengue and sand-fly fever, filariasis, tropical skin diseases and other maladies, . . . True, we have many maladies in Europe, but in order to compare the two sets of diseases we should compare the death-rates. Whereas in England it is a long way below 20 per thousand per annum, throughout the tropics it is nearer 40 per thousand. In India alone malaria kills over a million persons a year, and dysentery and malaria kills many hundreds of thousands. I have seen places in which the ordinary death-rate remains at between 50 and 60 per thousand; others which were so unhealthy that they were being deserted by their inhabitants; and others, lastly, which were simply uninhabitable. What would people say if such a state of things were to exist in most villages in England, Scotland, and Ireland?”<sup>1</sup>

On the whole it seems safe to say that in tropical countries the

<sup>1</sup> *United Empire*, February, 1913, pp. 123-124. Sir Ronald Ross, “Medical Science and the Tropics.”

density of population and the stage of culture depend to a large extent upon the amount and kind of fevers. Yet fevers are far from being the whole story. Few who have ever been in the torrid zone will deny that under prolonged and unvarying conditions of heat and dampness both physical and mental energy decline. One is tempted to sit down idly and rest and enjoy the warm air. When it is time for a new piece of work one tends to hesitate and to be uncertain as to just how to begin. Of course there are exceptions, and of course a long inheritance of activity in cooler regions will for years largely overcome these tendencies. Nevertheless of the scores of northerners, both American and Europeans, whom I have questioned in the torrid zone there was scarcely one who did not say that he worked less than at home. At first a considerable number said that they had as much energy as at home, but then they added that it was not necessary to work so hard, and moreover that they did not feel like it. Much more striking was the absolute unanimity with which they said that when they experienced a change of climate, especially if they went from lowlands to highlands, or still more when they returned to the north, they at once felt an access of energy which lasted some time after their return. To a New Englander accustomed to look upon our southern states as having a warm, debilitating climate, it is interesting to hear people in Guatemala speak of being stimulated as soon as they feel the cool winter air of New Orleans. The natives of the torrid zone are of course so accustomed to the heat that they enjoy it and suffer from even a slight degree of cold, but the very fact of being wonted to the heat seems to carry with it the necessity of working and thinking slowly. The universality with which this is recognized in Central America is significant. Again and again, when one asks about labor conditions in specific places, one is told, "Oh yes, the people there are all right, but you know it's always hot down there and they don't work much." All this, I know, is perfectly familiar, but it deserves emphasis because the great ruins are practically all in the hot country where "they don't work much."

In addition to debilitating fevers and an enervating uniformity of warm, moist atmospheric conditions, tropical countries suffer from

peculiar agricultural conditions. In the great forest such as that of Peten, where rain falls at all seasons, the making of clearings is practically impossible. In the dense jungle, such as that at an elevation of one to two thousand feet in the Pacific coffee belt of Guatemala, this is usually but not always possible. It depends on the length and character of the dry season in February, March, and April. Two or three weeks of steady sunshine are said to suffice to prepare the cut bushes and smaller branches of the trees for burning, but sometimes there is scarcely a rainless week during the whole year. This happened in 1913. People, who chanced to do their cutting early, burned their fields and were able to plant a corn crop, but many cut too late and failed. It is easy to say that everyone ought to cut and burn early, but in the first place the lethargy of the torrid zone leads people to put things off till the last moment. In the second place, if the land is burned over too early, weeds and bushes will sprout and grow to a height of a foot or two before it is time to plant the corn. Hence a second clearing will be necessary, and if a second burning is impossible the corn will be at a disadvantage.

This does not end the difficulties of agriculture in the dense jungle. Thanks to the abundant vegetation and constant rains or to the hot sun which causes rapid decomposition, or to some other unknown cause, many important chemical ingredients are quickly leached from the soil. Hence while the first corn crop is usually very abundant, the second, if it follows immediately after the first, is poor, so poor that it is scarcely worth raising. The regular custom is to cultivate a given tract one year, let the bushes grow four years, till they are perhaps fifteen or twenty feet high, and in the fifth year cut, burn, and plant again. Thus agriculture in the dense jungle is not only precarious, but it is forced to be extensive and superficial rather than intensive and careful. Therefore it does little to stimulate progress. In the drier regions, whether high or low, the soil is not so quickly exhausted, especially if the absence of roots or other conditions make it possible to turn up new soil by ploughing or otherwise. The crops are by no means so abundant as in the wetter places, but the same land can be cultivated year after year

with only short periods of rest. The cultivator must work harder than in the wet places, but his success is less precarious, the efforts of one year have a direct bearing on succeeding years, and permanent industry is encouraged.

Still another disadvantage of the low, wet regions needs to be briefly discussed. It is hard for mankind to get a living under any circumstances in the genuine tropical forest, and he must work at least moderately for one in the dry parts of tropical lands. In the big jungle, however, game is abundant, wild fruits ripen at almost all seasons, a few banana plants, palm trees, and yams will almost support a family, and if a corn crop is obtained at all, the return is large in proportion to the labor. Thus, so long as the population is not too dense, life is easy and there is little stimulus to effort. Under such conditions the density of population is not likely to increase, for only by a revolutionary access of skill and industry would it be possible to change from the easy, hand to mouth life of the present to the intensive, industrious life which would be necessary in order to support a dense population.

Thus far we have seen that the distribution of population in Guatemala to-day is unquestionably very different from what it was in the past. We have further seen that the physical conditions which make for density of population and increase of civilization are distributed in a peculiar fashion. They prevail in the highlands where there is no evidence that the civilization of the past was any higher than that of the present; and do not prevail in the lowlands where there is the clearest and most abundant evidence of the prevalence for many centuries of a civilization far in advance of that of to-day. Moreover the ancient civilization did not come to the country full-fledged as did that of Spain in later times. It did not do its finest work at once and then decline as did that of the Spaniards after they had built their massive old churches. On the contrary it apparently arose where we find its ruins, and it endured for centuries before it decayed. The most fundamental fact is not the great change which has taken place in the character of the Maya race. Nor is it the fall of Maya civilization, whether from internal decay or external attack. It is merely the simple fact that the



highest native American civilization grew up in one of the worst physical environments of the whole western hemisphere. Close at hand, in the Guatemalan highlands on one side, and in the dry strip of northern Yucatan on the other, far more favorable environments were occupied by closely allied branches of the same race, but the greatest civilization grew up in the densely forested, highly feverish, and almost untillable lowlands of Peten and eastern Guatemala.

The explanation of this peculiar state of affairs appears to lie in one or all of three things; first, the character of the Maya race; second, the relative abundance and virulence of various diseases; and third, the nature of the climate and its effect on forests, diseases, and agriculture. It is possible to adopt the usual unexpressed assumption of historians and to suppose that the original Mayas were stronger and more virile than any other race which has entered the torrid zone, and that because of some unexplained stimulus whose nature it is hard to surmise they flourished greatly for many centuries in a habitat in which modern races can barely subsist. The theory that the Mayas were different from other races has a good deal to commend it. They certainly were a remarkable people. The only question is how remarkable. The nearest analogue to their achievements is found in the ruins of Indo-China, Java, and Ceylon. In none of these cases, however, was the degree of success anything like so great as among the Mayas. The Asiatic races appear to have been like the Spaniards, invaders who did not develop a new civilization but brought their ideas with them from other places where we can still see remains of the parent culture. Moreover they did not rise to the height of inventing a method of writing, and, in Indo-China and Java at least, they appear to have had the advantage of tools of iron. Nevertheless, when their history is finally understood, we shall perhaps find that their civilization and that of the Mayas arose under similar conditions because of similar causes. This, however, is aside from the question. The important point is that no matter how capable we suppose the ancient Cingalese, Indo-Chinese, and Javanese to have been, the ancient Mayas were far more capable, for not only were the achieve-

ments of the Mayas greater than those of the others, but their opportunities were less. Hence, if we explain the rise of Maya culture solely on the basis of racial character we are forced to assume that the ancient Mayas were not only almost immeasurably in advance of any race that now lives under a similar environment, but were far more competent than any other race that has ever lived permanently in any part of the torrid zone. Indeed in their achievements in overcoming an adverse environment, we are perhaps obliged to put them on a pinnacle above any other race that has ever lived.

Without denying that the Mayas were a remarkable people, let us entertain the further hypothesis that in the days of their greatness tropical fevers either had not been introduced into America, or were by no means so virulent as now. This helps us greatly, for it relieves us of the necessity of assuming the Mayas to have possessed a degree of resistance to fevers far in excess of anything known to-day. There are, however, grave objections to this hypothesis. In the first place it is a pure assumption entirely unsupported by any independent evidence. In the second place, tropical diseases are numerous, and even malarial fevers are of several kinds. We may readily suppose that one or two diseases may have been introduced into Central America between the time of the Maya civilization and the Spanish Conquest, but in the entire absence of any evidence it is a rather large assumption to suppose that many diseases were thus introduced and that they were able to work so great a revolution. Thirdly, this hypothesis does not explain why the advancement of civilization went on so rapidly and for so long in spite of the enervating effects of almost unchanging heat and dampness. Nor does it explain why the Maya civilization reached the coast at only one or two spots. So far as topography is concerned there is nothing to prevent this on either coast. Much of the narrow Pacific plain could be cultivated with ease even though swamps do cover part of it, and on the Atlantic side the parts of the forest where there are no ruins seem to be no worse than those where they exist. The native inhabitants of this region all appear to have been of Maya stock, even though they may not have be-

longed to the main branch. Under such circumstances it hardly seems as if so progressive a civilization could have existed many centuries without extending its influence to the coast in British Honduras, unless there had been some preventive such as fever.

The assumption that in Central America tropical diseases were formerly less abundant or less baneful than now relieves us of the necessity of supposing that the Mayas, remarkable as they were, possessed a degree of immunity or resistance to disease far in excess of that of other races, but it does not relieve us of other difficulties. Moreover as it now stands it has the weakness of being a pure assumption with no assignable cause and no independent evidence. In order fully to explain the location of so high a civilization in Peten rather than in the highlands of Guatemala it seems necessary to supplement our assumptions as to the character of the Mayas and as to the prevalence of disease by the further assumption of a change of climate. The sort of change which would accomplish the required result would demand that at the height of Maya civilization climatic conditions should have been such that the forests of Peten would not be so dense as now, and hence that mosquitoes of the anopheles family would not be so abundant. In other words it would demand conditions like those which prevail to-day two hundred and fifty to three hundred miles north of Guatemala in the northern part of the peninsula of Yucatan. There the climate is to-day such that low jungle takes the place of dense forests. Mosquitoes of the anopheles species are rare. Malaria is comparatively unimportant. Thanks to these conditions the country is one of the most prosperous and progressive to be found anywhere within the tropics at sea-level. These favorable conditions are due to the fact that although heavy equatorial rains fall in summer and make the country fruitful, there is a long dry season during the winter and spring. If such conditions were to spread two hundred or three hundred miles southward into Peten that region would greatly change its character. Agriculture would still be subject to some handicaps, but would be nothing like so difficult and haphazard as at present. The areas of big jungle where life is excessively easy so long as the population is scanty, but where intensive agriculture

is to-day difficult would be reduced. Debilitating malarial fevers would prevail but little under such conditions, and the fact that Peten is a lowland, fertile and easily accessible, would make it a natural center of civilization. In other words if we adopt a climatic hypothesis of the kind here outlined, it does not lead us to abandon our other hypotheses as to the racial character of the Mayas, or as to the debilitating effects of disease. It simply supplies the elements which the other hypotheses lack.

The hypothesis of a change of climate in Guatemala by no means finds its only support in the considerations just set forth. On the contrary two independent lines of reasoning lead to the same conclusion. One of these is the existence of alluvial terraces in close connection with the ruins of Copan, and the other is the logical result of the investigation of ruins, lakes, and deserts in Asia, and of similar phenomena together with the growth of trees in North America. Both must be dismissed briefly. During the Pumpelly expedition sent out by the Carnegie Institution of Washington to Central Asia in 1903, Professor William M. Davis and the writer investigated a large number of alluvial terraces in mountain valleys from Persia eastward to Chinese Turkestan. From various lines of evidence set forth in the report<sup>2</sup> of that expedition they came to the conclusion that the terraces must be due to variations of climate. Otherwise they could scarcely occur with such a wide and regular distribution, and with such a minute adaptation to every valley no matter which way it sloped or how large it might be. Further study in the drier parts of the United States and northern Mexico as well as in Greece and Turkey seems to confirm this idea. It has been found, furthermore, that terraces of the same kind and apparently of the same climatic origin extend down into Southern Mexico and are well developed in the state of Oaxaca. In Guatemala the Motagua and other rivers are characterized by similar terraces which are described in full in the author's forthcoming volume on the "Climatic Factor" to be published shortly by the Carnegie Institution of Washington. It must suffice to say here that the famous

<sup>2</sup> "Explorations in Turkestan," Vol. I, 1905, Carnegie Institution of Washington, Publication No. 26.

ruins of Maya culture lie upon a terrace of exactly this sort, while below the ruins there lies another similar terrace formed since the ruins were built. This seems to indicate that since the foundation of Copan, probably early in the Christian era, there has been a double climatic change whereby the Copan River, after having filled up its valley to the level of the upper terrace, was then impelled, first, to carry away material from the valley bottom, next to deposit new material, and again to carry it away. In other words the terraces seem to afford independent evidence that since the building of Copan the climate of Guatemala has been subject to distinct pulsations.

The other line of evidence is so complex that only the results can here be stated. From a prolonged study of ruins in dry places, roads and deserts which are now impassable, traces of springs where no springs now exist, elevated strands of enclosed salt lakes, and other lines of historic, archæological and physiographic evidences the writer has been led to believe that in central and western Asia, Greece, north Africa and perhaps elsewhere climatic pulsations have taken place during historic times. A study of similar lines of evidence in the United States under the auspices of the Carnegie Institution in the years 1910-1912 led to a similar conclusion here. Finally still another independent line of research was adopted, namely the measurement of the rate of growth of the giant sequoia trees of California which grow in a region where the thickness of the rings depends largely upon the amount of rainfall. This led to the same conclusion, namely that pulsatory changes of climate have taken place to a marked degree during the past three thousand years. The nature of the change has been inferred from various sources, especially from a comparative study of the meteorological records during years when the trees of California grew rapidly or slowly during the last half century. From this it appears that moist periods in regions like Persia, Greece or Arizona are probably due to the fact that the cyclonic storms of winter not only move farther south than usual and hence are uncommonly frequent in those countries but perhaps begin earlier in the fall and last longer in the spring. This, of course, reduces the length of the dry season in summer.

Farther south in the torrid zone, however, the effect would appear to be the exact opposite. That is, if the belt of cyclonic storms is pushed equatorward in winter it would seem to mean that the belt of sub-tropical high pressure and drought whence the trade winds take their rise is also pushed equatorward. Thus during the winter the dry conditions of the semi-arid or desert belt which encircles the earth at about latitude  $25^{\circ}$  to  $30^{\circ}$  would be pushed farther toward the equator. The result of this would seem to be to force the trade winds so far south during winter that they would not have their present effect in causing rainfall throughout practically the whole winter in Peten. On the contrary, there would be a dry season of several months duration such as now prevails in Yucatan and in the Guatemalan Highlands. This would prevent the growth of forests and cause them to be replaced by jungle or bush. Here again, then, a third line of evidence appears to point to a pulsatory climatic change which would produce results in accordance with our first assumption.

Here we must let the matter rest. The theory of changes of climate involves so many historic and economic consequences that it demands most careful consideration. Perhaps it is possible to explain the peculiar location of the ancient Maya civilization on some other hypothesis, but thus far no other seems to be supported by so much independent evidence. The acceptance of the climatic theory does not oblige us to change our ideas as to the remarkable character of the Mayas, or as to the causes of the development of civilization. It merely provides conditions under which it becomes probable rather than merely possible that a race might have developed. In other words it removes the great difficulties of agriculture. It provides a habitat which to a certain extent would be more free than at present from the debilitating influences of heat and moisture; and it does away with the conditions that now cause such terrible fevers. In all these ways, then, while it does not conflict with accepted ideas as to the historic development of civilization, it removes some of the difficulties in the way of accepting those ideas.